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WPI, CLAIMS

(54) Liquid sampling apparatus

(57) Liquid sampling apparatus particularly suitable for use with a flow line (12) having an upstream portion (14) having a relatively high flow pressure and a downstream portion (16) having a relatively low flow pressure, a liquid receiving chamber (20) having an inlet (22) communicating with the upstream portion and an overflow outlet (24) communicating with the downstream portion (16), a sampling chamber (26) disposed below the liquid receiving chamber (20), a gravity flow conduit (28) communicating between the liquid receiving chamber (20) and the sampling chamber (26) and arranged to permit gravity flow of liquid from the liquid receiving chamber (20) to the sampling chamber (26) and an air relief conduit (30) extending from the sampling chamber (26) to the liquid receiving chamber (20) for preventing air from being trapped in the sampling chamber (26) as it is filled from the liquid receiving chamber (20) via the gravity flow conduit (28).

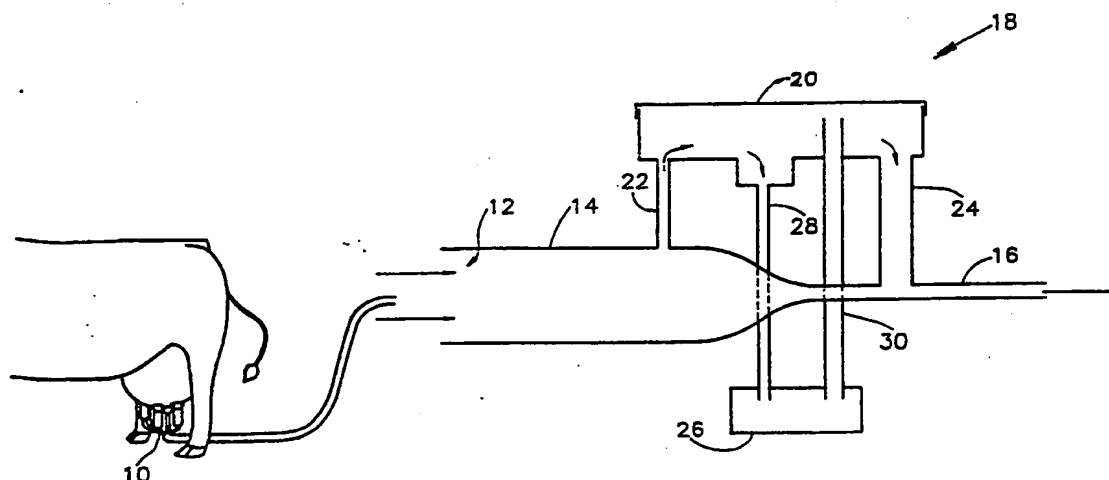
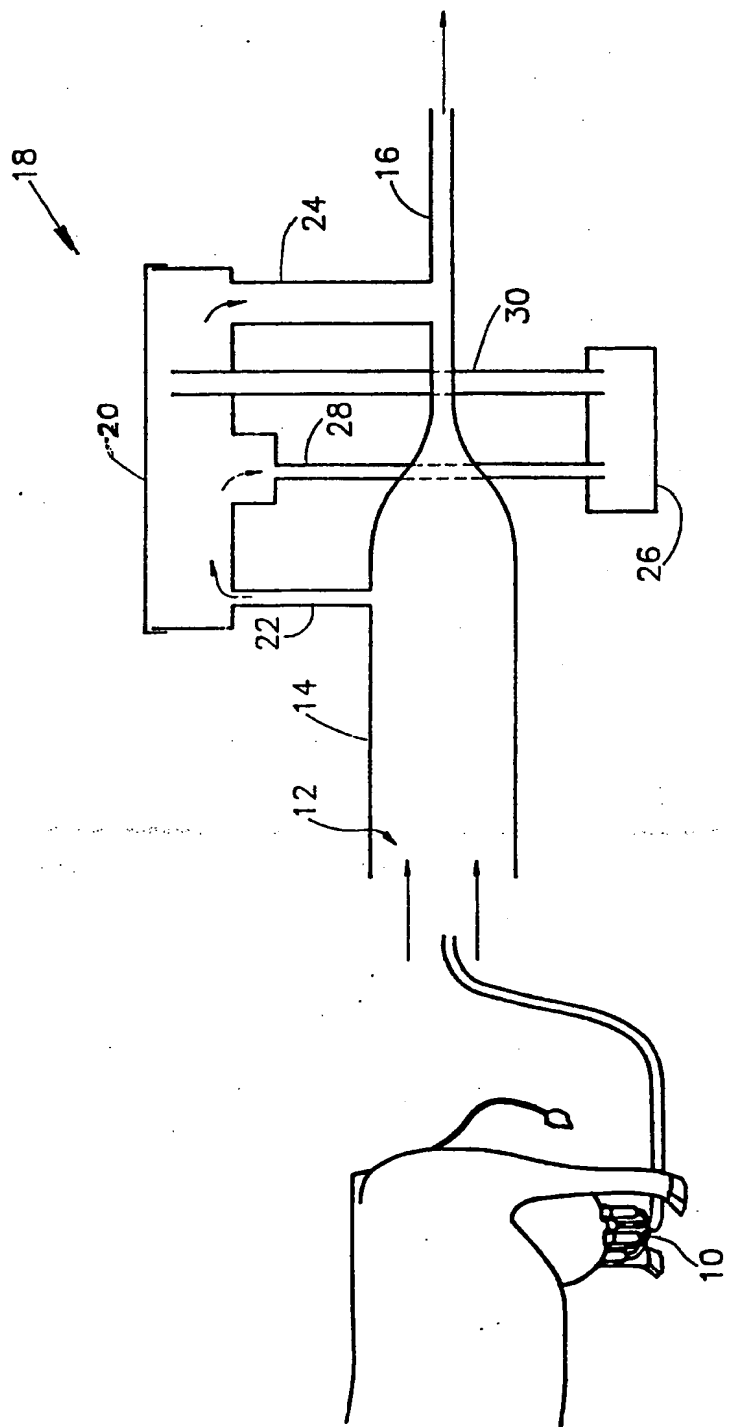


FIG. 1

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FIG.1



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FIELD OF THE INVENTION

The present invention relates generally to liquid sampling apparatus and more particularly to milk fat sampling apparatus.

BACKGROUND OF THE INVENTION

Various types of liquid sampling apparatus in general and milk fat sampling apparatus in particular are known in the art. The prior art is represented by the following patent references: U.S. Patents, 3,965,749; 3,250,129; 3,504,549; 4,167,117; 3,897,687; 4,131,011; 4,118,987; French Patent 73,40381 and Australian Patent 544,870 of the present inventor.

Australian Patent 544,870 describes and claims an arrangement for taking liquid samples including an arrangement for taking liquid samples from a pipe line in which the liquid flows in a pulsating flow where there are periods where no flow occurs, comprising a bypass line in the pipe line, the bypass line leading from one section of the flow pipe line which has a larger flow pressure to a section which has a lower flow pressure, a chamber being provided in the bypass line which chamber is filled during each pulse of the flow, the quantity of liquid in excess of the capacity of the chamber flowing into the section of lower pressure, the chamber being emptied by a gravitational flow via a passage leading into a sampling vessel, the passage being of such dimensions that the chamber is emptied

each time before the next pulse flow occurs.

It has been found that at high flow rates, the chamber does not entirely empty into the sampling vessel. As a result the liquid in the sampling vessel may not accurately represent the liquid passing through the sampling apparatus.

SUMMARY OF THE INVENTION

The present invention seeks to provide improved liquid sampling apparatus of the type described in Australian Patent 544,870 which overcomes the problem of incomplete emptying of the chamber into the sampling vessel and thus provides sampling of enhanced accuracy particularly at relatively high flow rates.

There is thus provided in accordance with a preferred embodiment of the present invention liquid sampling apparatus particularly suitable for use with a flow line having an upstream portion having a relatively high flow pressure and a downstream portion having a relatively low flow pressure, a liquid receiving chamber having an inlet communicating with the upstream portion and an overflow outlet communicating with the downstream portion, a sampling chamber disposed below the liquid receiving chamber, a gravity flow conduit communicating between the liquid receiving chamber and the sampling chamber and arranged to permit gravity flow of liquid from the liquid receiving chamber to the sampling chamber and an air relief conduit extending from the sampling chamber to the liquid receiving chamber for preventing air from being trapped in the sampling chamber as it is filled from the liquid receiving chamber via the gravity flow conduit.

In accordance with a preferred embodiment of the invention, the liquid sampling apparatus forms part of an automated milking system and the flow line is part of an output flow line coupled to a milking cluster.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawing in which:

Fig. 1 is a partially pictorial, partially schematic illustration of liquid sampling apparatus constructed and operative in accordance with a preferred embodiment of the invention, forming part of an automated milking system.

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DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Fig. 1, which is a partially pictorial, partially schematic illustration of liquid sampling apparatus constructed and operative in accordance with a preferred embodiment of the present invention forming part of an automated milking system. It is appreciated that the liquid sampling apparatus of the present invention is not limited to use with milk or as part of an automated milking system, but does find particular utility in an automated milking environment.

In the illustrated preferred embodiment, milk from a milking cluster 10 is supplied to a milk flow line 12 having an upstream portion 14 of relatively large cross sectional diameter at which the flow pressure is relatively high and a downstream portion 16 of relatively small cross sectional diameter at which the flow pressure is relatively low.

In accordance with the present invention, there is provided sampling apparatus 18 including a liquid receiving chamber 20, typically disposed above the flow line 12 and communicating with upstream portion 14 via a conduit 22. The liquid receiving chamber 20 also communicates with the downstream portion 16 via an overflow conduit 24.

The sampling apparatus 18 also comprises a sampling chamber 26 which is disposed below liquid receiving chamber 20 and receives a flow of liquid from liquid receiving chamber 20 by gravity along a generally vertical liquid flow conduit 28. According to a preferred embodiment of the invention, there is also provided an air relief conduit 30 which communicates from the sampling chamber 26 to the liquid receiving chamber 20. The

provision of air relief conduit 30 prevents the trapping of air in chamber 26, which could otherwise impede the gravity flow of liquid from liquid receiving chamber 20 into sampling chamber 26.

It is a particular feature of the present invention that the air relief is internal to the sampling system which is closed from the atmosphere and pressurized during operation and thus does not require any seals or pressure locks for proper operation.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove, rather the scope of the invention is defined only by the claims which follow:

C L A I M S

1. Liquid sampling apparatus particularly suitable for use with a flow line having an upstream portion having a relatively high flow pressure and a downstream portion having a relatively low flow pressure, and comprising:

a liquid receiving chamber having an inlet communicating with the upstream portion and an overflow outlet communicating with the downstream portion;

a sampling chamber disposed below the liquid receiving chamber;

a gravity flow conduit communicating between the liquid receiving chamber and the sampling chamber and arranged to permit gravity flow of liquid from the liquid receiving chamber to the sampling chamber; and

an air relief conduit extending from the sampling chamber to the liquid receiving chamber for preventing air from being trapped in the sampling chamber as it is filled from the liquid receiving chamber via the gravity flow conduit.

2. Liquid sampling apparatus according to claim 1 and wherein said sampling chamber, said liquid receiving chamber and said conduits are all maintained at generally the same pressure.

3. Liquid sampling apparatus according to claim 1 and wherein said sampling chamber, said liquid receiving chamber and said conduits are all maintained at a pressure above atmospheric pressure.

4. Liquid sampling apparatus according to claim 2 and wherein said sampling chamber, said liquid receiving chamber and said conduits are all maintained at a pressure above atmospheric pressure.

5. An automated milking system comprising:

a plurality of milking clusters;

at least one flow line coupled to said milking clusters and to milk collection means and having an upstream portion having a relatively high flow pressure and a downstream portion having a relatively low flow pressure, and comprising:

a liquid receiving chamber having an inlet communicating with the upstream portion and an overflow outlet communicating with the downstream portion;

a sampling chamber disposed below the liquid receiving chamber;

a gravity flow conduit communicating between the liquid receiving chamber and the sampling chamber and arranged to permit gravity flow of liquid from the liquid receiving chamber to the sampling chamber; and

an air relief conduit extending from the sampling chamber to the liquid receiving chamber for preventing air from being trapped in the sampling chamber as it is filled from the liquid receiving chamber via the gravity flow conduit.